The UWIS isotope separator

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Since few years the main activities of the UWIS group are devoted to development of the IGISOL project at the Heavy Ion Laboratory of Warsaw University [1, 2]. After first test experiments a series of improvements was introduced last two years. The most important of them were a new helium supply and control system and additional vacuum pumps.

The new helium supply and control system consists of high quality stainless steel Swagelok elements and control units for helium flow. Application of this design had considerably decreased the impurities in the helium passing through the helium cell.

Two additional pumps, a primary pump and a turbo one installed at the extraction region of the IGISOL had improved the vacuum about one order of magnitude in the region between the helium cell and the extraction electrode of the mass separator.

These improvements had caused increasing of efficiency of the gas cell and extraction system about 8 times in comparison with the previous conditions.

In these conditions a α source (^{223}Ra) was installed in the helium chamber and the investigations of a gas catcher/ion guide system were continued. The gas cell (helium chamber) of 120 cm^3 volume was filled with high-purity (99,9999%) helium. The α spectra of the recoil nucleus ^{219}Rn (T_1=3,96 s) and its dauther ^{215}Po (T_1=1,78 ms) were measured by two silicon detectors placed in front of and behind the isotope separator magnet. Extraction efficiences for ^{219}Rn and ^{215}Po ions were measured as function of helium pressure in the cell and distance of the ^{223}Ra source from the cell exit hole. In order to investigate the so called "plasma effect" the 3,5 MeV/u 14N beam was passed through the cell for some measurements.

The efficiency of the gas catcher/ion system measured for ^{219}Rn was between 25% and 55% depending on the position of the α source and without mass separation. After mass separation the maximum yield is 10%, decreasing with ^{14}N beam by a factor of $\sim$9 for both ^{219}Rn^{1+} and ^{215}Po^{1+} ions. The estimated extraction time of 2,4 ms is obtained for

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$^{215}Po^{1+}$.

In the later measurements the α source (^{223}Ra) was removed and the heavy-ion reaction ^{14}N (5,8 MeV/u)+^{209}Bi was studied. The short-lived products ^{213}Rn (T_1=25 ms), ^{214}Ra (T_1=2,5 s) and ^{215}Ra (T_1=1,6 ms) were identified. The observation of the very short-lived isotope ^{215}Ra seems to confirm the promissing results concerning the high extraction efficiency, the short extraction time and limited influence of the plasma effect [3].

These works are partly performed in the frame of the Warsaw University - IN2P3 (France) and the RTD Ion Catcher (European) collaborations.

References

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[2] A. Wojtasiewicz et al., HIL Warsaw Univ. Ann. Rep. 1998, p. 15
[3] A. Wojtasiewicz et al., RNB6 Conf. ANL Sept. 22-26 (2003) to be published in Nucl. Phys. A